

1

SEQUENCE LISTING

<110> Meiji Seika Kaisha LTD.

<120> Triterpene hydroxylase

<130> P05160900

<150> JP 2004-049123

<151> 2004-02-25

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<170> PatentIn version 3.1

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<213> Artificial

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31

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1 5 10 15	

tca acc att ctg ata cgt tcc atc ttc aag aaa cca cag cgt cta aga	96
Ser Thr Ile Leu Ile Arg Ser Ile Phe Lys Lys Pro Gln Arg Leu Arg	
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ctc cca ccg ggt cct cca att tca gta ccc ttg ctg gga cac gcg cca	144
Leu Pro Pro Gly Pro Pro Ile Ser Val Pro Leu Leu Gly His Ala Pro	
35 40 45	

tat ctc cgt tca ctg ctc cac caa gcc ttg tac aag cta tca ctg cgc	192
Tyr Leu Arg Ser Leu Leu His Gln Ala Leu Tyr Lys Leu Ser Leu Arg	
50 55 60	

tat gga ccc ttg atc cac gtc atg atc ggt tcg aag cac gtg gtg gtg	240
Tyr Gly Pro Leu Ile His Val Met Ile Gly Ser Lys His Val Val Val	
65 70 75 80	

gcg tcg tcg gcg gag acg gcc aag cag atc ctc aaa acc tcg gag gag	288
Ala Ser Ser Ala Glu Thr Ala Lys Gln Ile Leu Lys Thr Ser Glu Glu	
85 90 95	

gca ttc tgc aac cgt ccc tta atg ata gcg acg gag acg cta acc tac	336
Ala Phe Cys Asn Arg Pro Leu Met Ile Ala Ser Glu Ser Leu Thr Tyr	
100 105 110	

ggc gcg gcg gac tac ttc atc ccc tac ggc aca tac tgg cgg ttc	384
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Gly Ala Ala Asp Tyr Phe Phe Ile Pro Tyr Gly Thr Tyr Trp Arg Phe			
115	120	125	
ctg aag aag ctc tgc atg acg gag ctt ctg agc ggg aag acc ctg gag			432
Leu Lys Lys Leu Cys Met Thr Glu Leu Leu Ser Gly Lys Thr Leu Glu			
130	135	140	
cat ttc gtg aga atc cgc gag agc gag gtg gag gcg ttc ctc aag aga			480
His Phe Val Arg Ile Arg Glu Ser Glu Val Glu Ala Phe Leu Lys Arg			
145	150	155	160
atg atg gag att tca ggc aat gga aat tac gag gtg gtg atg agg aag			528
Met Met Glu Ile Ser Gly Asn Gly Asn Tyr Glu Val Val Met Arg Lys			
165	170	175	
gag ctc ata acg cac acg aat aac atc atc acg agg atg ata atg ggg			576
Glu Leu Ile Thr His Thr Asn Asn Ile Ile Thr Arg Met Ile Met Gly			
180	185	190	
aag aag agt aat gcg gaa aac gat gag gtg gcc agg ttg agg aag gtg			624
Lys Lys Ser Asn Ala Glu Asn Asp Glu Val Ala Arg Leu Arg Lys Val			
195	200	205	
gtg agg gag gtc ggg gag ttg ctt ggg gcg ttt aac ttg ggg gat gtt			672
Val Arg Glu Val Gly Glu Leu Leu Gly Ala Phe Asn Leu Gly Asp Val			
210	215	220	
att ggg ttc atg agg cct ttg gat ctg caa ggg ttt ggg aag aag aac			720
Ile Gly Phe Met Arg Pro Leu Asp Leu Gln Gly Phe Gly Lys Lys Asn			
225	230	235	240
atg gaa act cac cac aag gtg gat gcg atg atg gag aag gtg ttg agg			768
Met Glu Thr His His Lys Val Asp Ala Met Met Glu Lys Val Leu Arg			
245	250	255	
gag cat gag gag gct agg gct aag gaa gat gct gac tct gat agg aag			816
Glu His Glu Ala Arg Ala Lys Glu Asp Ala Asp Ser Asp Arg Lys			
260	265	270	
aag gat ctt ttt gat att ttg ttg aac ctc att gaa gct gat ggt gct			864
Lys Asp Leu Phe Asp Ile Leu Leu Asn Leu Ile Glu Ala Asp Gly Ala			
275	280	285	
gac aat aag ctc act aga gag agt gcc aaa gcc ttt gct ctg gac atg			912
Asp Asn Lys Leu Thr Arg Glu Ser Ala Lys Ala Phe Ala Leu Asp Met			
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ttc atc gcc ggc aca aac ggc ccc gca agc gtc cta gag tgg tca ctg			960

Phe Ile Ala Gly Thr Asn Gly Pro Ala Ser Val Leu Glu Trp Ser Leu						
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Ala Glu Leu Val Arg Asn Pro His Val Phe Lys Lys Ala Arg Glu Glu						
325				330	335	
att gag tca gtg gta ggc aaa gaa agg ctg gtc aaa gaa tca gac att				1056		
Ile Glu Ser Val Val Gly Lys Glu Arg Leu Val Lys Glu Ser Asp Ile						
340				345	350	
ccc aac cta cca tac cta caa gca ttg ctg aag gaa acc cta agg ctg				1104		
Pro Asn Leu Pro Tyr Leu Gln Ala Leu Leu Lys Glu Thr Leu Arg Leu						
355				360	365	
cac ccg cca acc cca ata ttc gca aga gaa gcc atg cga aca tgc cag				1152		
His Pro Pro Thr Pro Ile Phe Ala Arg Glu Ala Met Arg Thr Cys Gln						
370				375	380	
gtt gaa ggc tac gac att ccg gaa aat tcc act att ttg atc agc aca				1200		
Val Glu Gly Tyr Asp Ile Pro Glu Asn Ser Thr Ile Leu Ile Ser Thr						
385				390	395	400
tgg gcc att ggt agg gat cca aat tac tgg gat gac gca ctc gag tac				1248		
Trp Ala Ile Gly Arg Asp Pro Asn Tyr Trp Asp Asp Ala Leu Glu Tyr						
405				410	415	
aag ccg gag agg ttc ttg ttc tcc gac gac ccg ggc aag agc aag att				1296		
Lys Pro Glu Arg Phe Leu Phe Ser Asp Asp Pro Gly Lys Ser Lys Ile						
420				425	430	
gac gtg agg ggg cag tac tat cag ctc ctg ccc ttt ggg agc ggg aga				1344		
Asp Val Arg Gly Gln Tyr Tyr Gln Leu Leu Pro Phe Gly Ser Gly Arg						
435				440	445	
aga agc tgc ccc gga gcc tcg cta gcg ttg ctt gtc atg caa gca acg				1392		
Arg Ser Cys Pro Gly Ala Ser Leu Ala Leu Leu Val Met Gln Ala Thr						
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cta gct agt ttg atc cag tgc ttc gac tgg atc gtt aat gat ggt aaa				1440		
Leu Ala Ser Leu Ile Gln Cys Phe Asp Trp Ile Val Asn Asp Gly Lys						
465				470	475	480
aac cat cat gtt gac atg tct gag gaa ggg agg gtg act gtg ttt ttg				1488		
Asn His His Val Asp Met Ser Glu Glu Gly Arg Val Thr Val Phe Leu						
485				490	495	
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 Ala

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Leu Pro Pro Gly Pro Pro Ile Ser Val Pro Leu Leu Gly His Ala Pro
 35 40 45

Tyr Leu Arg Ser Leu Leu His Gln Ala Leu Tyr Lys Leu Ser Leu Arg
 50 55 60

Tyr Gly Pro Leu Ile His Val Met Ile Gly Ser Lys His Val Val Val
 65 70 75 80

Ala Ser Ser Ala Glu Thr Ala Lys Gln Ile Leu Lys Thr Ser Glu Glu
 85 90 95

Ala Phe Cys Asn Arg Pro Leu Met Ile Ala Ser Glu Ser Leu Thr Tyr
 100 105 110

Gly Ala Ala Asp Tyr Phe Phe Ile Pro Tyr Gly Thr Tyr Trp Arg Phe
 115 120 125

Leu Lys Lys Leu Cys Met Thr Glu Leu Leu Ser Gly Lys Thr Leu Glu

130

135

140

His Phe Val Arg Ile Arg Glu Ser Glu Val Glu Ala Phe Leu Lys Arg
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Met Met Glu Ile Ser Gly Asn Gly Asn Tyr Glu Val Val Met Arg Lys
165 170 175

Glu Leu Ile Thr His Thr Asn Asn Ile Ile Thr Arg Met Ile Met Gly
180 185 190

Lys Lys Ser Asn Ala Glu Asn Asp Glu Val Ala Arg Leu Arg Lys Val
195 200 205

Val Arg Glu Val Gly Glu Leu Leu Gly Ala Phe Asn Leu Gly Asp Val
210 215 220

Ile Gly Phe Met Arg Pro Leu Asp Leu Gln Gly Phe Gly Lys Lys Asn
225 230 235 240

Met Glu Thr His His Lys Val Asp Ala Met Met Glu Lys Val Leu Arg
245 250 255

Glu His Glu Glu Ala Arg Ala Lys Glu Asp Ala Asp Ser Asp Arg Lys
260 265 270

Lys Asp Leu Phe Asp Ile Leu Leu Asn Leu Ile Glu Ala Asp Gly Ala
275 280 285

Asp Asn Lys Leu Thr Arg Glu Ser Ala Lys Ala Phe Ala Leu Asp Met
290 295 300

Phe Ile Ala Gly Thr Asn Gly Pro Ala Ser Val Leu Glu Trp Ser Leu
305 310 315 320

Ala Glu Leu Val Arg Asn Pro His Val Phe Lys Lys Ala Arg Glu Glu

325 330 335

Ile Glu Ser Val Val Gly Lys Glu Arg Leu Val Lys Glu Ser Asp Ile
340 345 350

Pro Asn Leu Pro Tyr Leu Gln Ala Leu Leu Lys Glu Thr Leu Arg Leu
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His Pro Pro Thr Pro Ile Phe Ala Arg Glu Ala Met Arg Thr Cys Gln
370 375 380

Val Glu Gly Tyr Asp Ile Pro Glu Asn Ser Thr Ile Leu Ile Ser Thr
385 390 395 400

Trp Ala Ile Gly Arg Asp Pro Asn Tyr Trp Asp Asp Ala Leu Glu Tyr
405 410 415

Lys Pro Glu Arg Phe Leu Phe Ser Asp Asp Pro Gly Lys Ser Lys Ile
420 425 430

Asp Val Arg Gly Gln Tyr Tyr Gln Leu Leu Pro Phe Gly Ser Gly Arg
435 440 445

Arg Ser Cys Pro Gly Ala Ser Leu Ala Leu Leu Val Met Gln Ala Thr
450 455 460

Leu Ala Ser Leu Ile Gln Cys Phe Asp Trp Ile Val Asn Asp Gly Lys
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Asn His His Val Asp Met Ser Glu Glu Gly Arg Val Thr Val Phe Leu
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tca acc att ctg ata cgt tcc atc ttc aag aaa cca cag cgt cta aga					96
Ser Thr Ile Leu Ile Arg Ser Ile Phe Lys Lys Pro Gln Arg Leu Arg					
20	25		30		
ctc cca ccg ggt cct cca att tca ata ccc ttg ctg gga cac ggc cca					144
Leu Pro Pro Gly Pro Pro Ile Ser Ile Pro Leu Leu Gly His Ala Pro					
35	40		45		
tat ctc cgt tca ctg ctc cac caa gca ttg tac aag cta tca ctg cgc					192
Tyr Leu Arg Ser Leu Leu His Gln Ala Leu Tyr Lys Leu Ser Leu Arg					
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tat gga ccc ttg atc cac gtc atg atc ggt tcg aag cac gtg gtg gtg					240
Tyr Gly Pro Leu Ile His Val Met Ile Gly Ser Lys His Val Val Val					
65	70		75		80
gcg tcg tcg gcg gag acg gcc aag cag atc ctc aaa acc tcg gag gag					288
Ala Ser Ser Ala Glu Thr Ala Lys Gln Ile Leu Lys Thr Ser Glu Glu					
85	90		95		
gca ttc tgc aac cgt ccc tta atg ata gcg acg gag agc cta acc tac					336
Ala Phe Cys Asn Arg Pro Leu Met Ile Ala Ser Glu Ser Leu Thr Tyr					
100	105		110		
ggc gcg gcg gac tac ttc atc ccc tac ggc aca tac tgg cgg ttc					384
Gly Ala Ala Asp Tyr Phe Phe Ile Pro Tyr Gly Thr Tyr Trp Arg Phe					
115	120		125		
ctg aag aag ctc tgc atg acg gag ctt ctg acg ggg aag acc ctg gag					432
Leu Lys Lys Leu Cys Met Thr Glu Leu Leu Ser Gly Lys Thr Leu Glu					

130	135	140	
cat ttc gtg aga atc cgc gag agc gag gtg gag gcg ttc ctc aag aga His Phe Val Arg Ile Arg Glu Ser Glu Val Glu Ala Phe Leu Lys Arg			480
145	150	155	160
atg atg gag att tca ggc aat gga aat tac gag gtg gtg atg agg aag Met Met Glu Ile Ser Gly Asn Gly Asn Tyr Glu Val Val Met Arg Lys			528
165	170	175	
gag ctc ata acg cac acg aat aac atc atc acg agg atg ata atg ggg Glu Leu Ile Thr His Thr Asn Asn Ile Ile Thr Arg Met Ile Met Gly			576
180	185	190	
aag aag agt aat gcg gaa aac gat gag gtg gcc agg ttg agg aag gtg Lys Lys Ser Asn Ala Glu Asn Asp Glu Val Ala Arg Leu Arg Lys Val			624
195	200	205	
gtg agg gag gtc ggg gag ttg ctt ggg gcg ttt aac ttg ggg gat gtt Val Arg Glu Val Gly Glu Leu Leu Gly Ala Phe Asn Leu Gly Asp Val			672
210	215	220	
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225	230	235	240
atg gaa act cac cac aag gtg gat gcg atg atg gag aag gtg ttg agg Met Glu Thr His His Lys Val Asp Ala Met Met Glu Lys Val Leu Arg			768
245	250	255	
gag cat gag gag gct agg gct aag gaa gat gct gac tct gat agg aag Glu His Glu Ala Arg Ala Lys Glu Asp Ala Asp Ser Asp Arg Lys			816
260	265	270	
aag gat ctt ttt gat att ttg ttg aac ctc att gaa gct gat ggt gct Lys Asp Leu Phe Asp Ile Leu Leu Asn Leu Ile Glu Ala Asp Gly Ala			864
275	280	285	
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290	295	300	
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325	330	335	
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355	360	365	
cac ccg cca acc cca ata ttc gca aga gaa gcc atg cga aca tgc cag His Pro Pro Thr Pro Ile Phe Ala Arg Glu Ala Met Arg Thr Cys Gln			1152
370	375	380	
gtt gaa ggc tac gac att ccg gaa aat tcc act att ttg atc agc aca Val Glu Gly Tyr Asp Ile Pro Glu Asn Ser Thr Ile Leu Ile Ser Thr			1200
385	390	395	400
tgg gcc att ggt agg gat cca aat tac tgg gat gac gca ctc gag tac Trp Ala Ile Gly Arg Asp Pro Asn Tyr Trp Asp Asp Ala Leu Glu Tyr			1248
405	410	415	
aag ccg gag agg ttc ttg ttc tcc gac gac ccg ggc aag agc aag att Lys Pro Glu Arg Phe Leu Phe Ser Asp Asp Pro Gly Lys Ser Lys Ile			1296
420	425	430	
gac gtg agg ggg cag tac tat cag ctc ctg ccc ttt ggg agc ggg aga Asp Val Arg Gly Gln Tyr Tyr Gln Leu Leu Pro Phe Gly Ser Gly Arg			1344
435	440	445	
aga agc tgc ccc gga gcc tcg cta gcg ttg ctt gtc atg caa gca acg Arg Ser Cys Pro Gly Ala Ser Leu Ala Leu Val Met Gln Ala Thr			1392
450	455	460	
cta gcg agt ttg atc cag tgc ttc gac tgg atc gtt aat gat ggt aaa Leu Ala Ser Leu Ile Gln Cys Phe Asp Trp Ile Val Asn Asp Gly Lys			1440
465	470	475	480
aac cat cat gtt gac atg tct gag gaa ggg agg gtg act gtg ttt ttg Asn His His Val Asp Met Ser Glu Glu Gly Arg Val Thr Val Phe Leu			1488
485	490	495	
gcc aag cca ctc aag tgc aag cct gtt ccg cgt ttc act ccg ttc got Ala Lys Pro Leu Lys Cys Lys Pro Val Pro Arg Phe Thr Pro Phe Ala			1536
500	505	510	
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Ser Thr Ile Leu Ile Arg Ser Ile Phe Lys Lys Pro Gln Arg Leu Arg
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Leu Pro Pro Gly Pro Pro Ile Ser Ile Pro Leu Leu Gly His Ala Pro
35 40 45

Tyr Leu Arg Ser Leu Leu His Gln Ala Leu Tyr Lys Leu Ser Leu Arg
50 55 60

Tyr Gly Pro Leu Ile His Val Met Ile Gly Ser Lys His Val Val Val
65 70 75 80

Ala Ser Ser Ala Glu Thr Ala Lys Gln Ile Leu Lys Thr Ser Glu Glu
85 90 95

Ala Phe Cys Asn Arg Pro Leu Met Ile Ala Ser Glu Ser Leu Thr Tyr
100 105 110

Gly Ala Ala Asp Tyr Phe Phe Ile Pro Tyr Gly Thr Tyr Trp Arg Phe
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Leu Lys Lys Leu Cys Met Thr Glu Leu Leu Ser Gly Lys Thr Leu Glu
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His Phe Val Arg Ile Arg Glu Ser Glu Val Glu Ala Phe Leu Lys Arg
145 150 155 160

Met Met Glu Ile Ser Gly Asn Gly Asn Tyr Glu Val Val Met Arg Lys
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Glu Leu Ile Thr His Thr Asn Asn Ile Ile Thr Arg Met Ile Met Gly
180 185 190

Lys Lys Ser Asn Ala Glu Asn Asp Glu Val Ala Arg Leu Arg Lys Val
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Val Arg Glu Val Gly Glu Leu Leu Gly Ala Phe Asn Leu Gly Asp Val
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Ile Gly Phe Met Arg Pro Leu Asp Leu Gln Gly Phe Gly Lys Lys Asn
225 230 235 240

Met Glu Thr His His Lys Val Asp Ala Met Met Glu Lys Val Leu Arg
245 250 255

Glu His Glu Glu Ala Arg Ala Lys Glu Asp Ala Asp Ser Asp Arg Lys
260 265 270

Lys Asp Leu Phe Asp Ile Leu Leu Asn Leu Ile Glu Ala Asp Gly Ala
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Asp Asn Lys Leu Thr Arg Glu Ser Ala Lys Ala Phe Ala Leu Asp Met
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Phe Ile Ala Gly Thr Asn Gly Pro Ala Ser Val Leu Glu Trp Ser Leu
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Ala Glu Leu Val Arg Asn Pro His Val Phe Lys Lys Ala Arg Glu Glu
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Ile Glu Ser Val Val Gly Lys Glu Arg Leu Val Lys Glu Ser Asp Ile
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Pro Asn Leu Pro Tyr Leu Gln Ala Val Leu Lys Glu Thr Leu Arg Leu
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His Pro Pro Thr Pro Ile Phe Ala Arg Glu Ala Met Arg Thr Cys Gin
370 375 380

Val Glu Gly Tyr Asp Ile Pro Glu Asn Ser Thr Ile Leu Ile Ser Thr
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Trp Ala Ile Gly Arg Asp Pro Asn Tyr Trp Asp Asp Ala Leu Glu Tyr
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Lys Pro Glu Arg Phe Leu Phe Ser Asp Asp Pro Gly Lys Ser Ile
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Asp Val Arg Gly Gln Tyr Tyr Gln Leu Leu Pro Phe Gly Ser Gly Arg
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Arg Ser Cys Pro Gly Ala Ser Leu Ala Leu Leu Val Met Gln Ala Thr
450 455 460

Leu Ala Ser Leu Ile Gln Cys Phe Asp Trp Ile Val Asn Asp Gly Lys
465 470 475 480

Asn His His Val Asp Met Ser Glu Glu Gly Arg Val Thr Val Phe Leu
485 490 495

Ala Lys Pro Leu Lys Cys Lys Pro Val Pro Arg Phe Thr Pro Phe Ala
500 505 510

Ala